

TECHNICAL REPORT 1971
August 2008

The Future SSC Pacific Civil Service Workforce

P. Shigley
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SSC San Diego

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This report was prepared for the Naval Postgraduate School, Monterey, California, by the Technical Knowledge Management Division (Code 735), SPAWAR Systems Center San Diego.

Released under authority of
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EXECUTIVE SUMMARY

OBJECTIVES

Current demographic trends for SPAWAR Systems Center San Diego (SSC San Diego) accessions versus separations remain unclear, particularly as the organization faces a potential retirement wave. To this end, this study supports strategic leadership decisions on future recruitment and retention initiatives by:

- Providing visibility into future hiring
- Providing understanding of the make-up and availability of qualified future hire pools
- Assessing future Center demographic trends

While relevant analysis has come before it, including a recent RAND study, *Civilian Workforce Planning in the Department of Defense*, a 2000 CNA study, *Civil Service Workforce After Strategic Sourcing*, and a 2007 Government Accountability Office study of the National Aeronautics and Space Administration's human capital management, *Progress Made on Strategic Human Capital Management, but Future Program Management Challenges Remain*, the scope of this study relates specifically to science and engineering personnel at SSC San Diego, leveraging data provided by the Center.

METHOD

The methodology for this study was a gap analysis. The gap analysis defined SSC San Diego's future hiring challenges, in terms of its Science and Engineering workforce. The gap, or lack of a gap, was determined by projecting the demand, with adjustments for the local economy as articulated in high and low unemployment projections, against the expected engineering graduate yield from U.S. colleges and universities, California, and SSC San Diego current recruiting targets. Options were based on SSC San Diego's projected future recruiting pool within the 2008–2017 timeframe.

FINDINGS

Two distinct findings were derived from this study. First, based on current hiring priority and assuming past accession and separation trends hold constant over the timeframe mentioned above, SSC San Diego's recruiting will most likely continue to meet accession needs over the study's projected 10-year timeframe. Recruitment efforts are currently focused on three specific disciplines: Electrical Engineering, Computer Engineering, and Computer Science. Second, SSC San Diego's science and technology physical scientists and mathematics workforce is changing rapidly. Over the last 20 years, the population of physicists has declined by 20 percent while that of mathematicians has dropped by 40 percent. In addition, both of these disciplines have and continue to age more rapidly than other disciplines, with a median age of 53 years (Figures 1 and 2). Over the long term, this trend may negatively impact the Center's ability to maintain its current research and development as well as science and technology capability.

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PROBLEM STATEMENT

SPAWAR Systems Center San Diego (SSC San Diego) relies on scientists and engineers to successfully carry out its mission.¹ However, SSC San Diego needs a clear assessment of the macro level trends that are likely to affect its recruitment and retention initiatives. Currently, SSC San Diego leadership is concerned with the forecasted federal government-wide “retirement tsunami” and how it can position itself to assuage the effects of heretofore unseen employee separations. However, senior leadership does not have a clear picture of the current workforce demographic, retirement rates, or other issues that affect human capital at the Center. Moreover, they have not seen a forecast that can provide them with an idea of how large the recruitment gap will become in the coming years. This study attempts to bridge some of these information gaps and thus enable informed discussions on potential adjustments in acquiring and retaining the future workforce.

STUDY OBJECTIVES

As stated, current demographic trends for SSC San Diego accessions versus separations remain unclear, particularly as the organization faces a potential retirement wave. To address this issue, this study supports strategic leadership decisions on future recruitment and retention initiatives by providing visibility into future hiring and understanding of the make-up and availability of qualified future hire pools, and assessing future Center demographic trends.

While relevant analysis has been published before (including a recent RAND study, *Civilian Workforce Planning in the Department of Defense*; a 2000 CNA study, *Civil Service Workforce After Strategic Sourcing*; and a 2007 Government Accountability Office study of National Aeronautics and Space Administration’s human capital management, *Progress Made on Strategic Human Capital Management, but Future Program Management Challenges Remain*), the scope of this study relates specifically to science and engineering personnel at SSC San Diego, leveraging data specific to this organization.

FINDINGS

Two distinct findings were derived from this study. First, based on the current hiring priority, SSC San Diego’s recruiting will most likely continue to meet accession needs over the study’s projected 10-year timeframe. Recruitment efforts are currently focused on three specific disciplines: electrical engineering, computer engineering, and computer science. Second, SSC San Diego’s science and technology (S&T) physical scientists and mathematics workforce is changing rapidly. Over the last 20 years, the population of physicists has declined by 20 percent while that of mathematicians has dropped by 40 percent. In addition, both disciplines continue to age more rapidly than other disciplines, with a median age of 53 years (Figures 1 and 2). Over the long term, this trend may negatively impact the Center’s ability to maintain its current research and development (R&D) as well as S&T capability.

¹ SSC San Diego is scheduled to be renamed SSC Pacific in October 2008 as result of BRAC 2005.

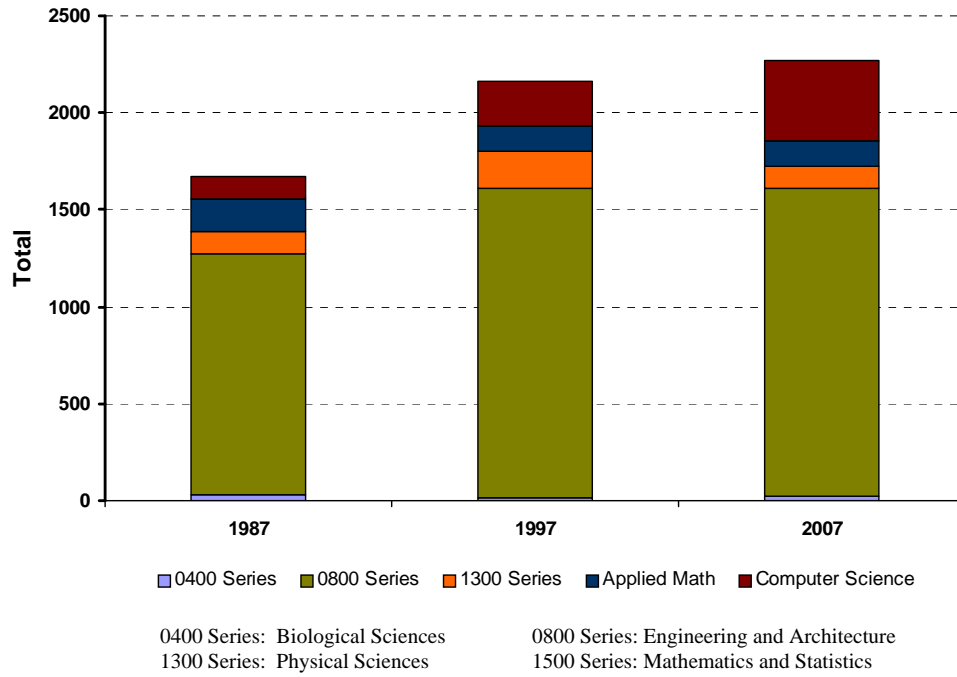


Figure 1. Competency population.

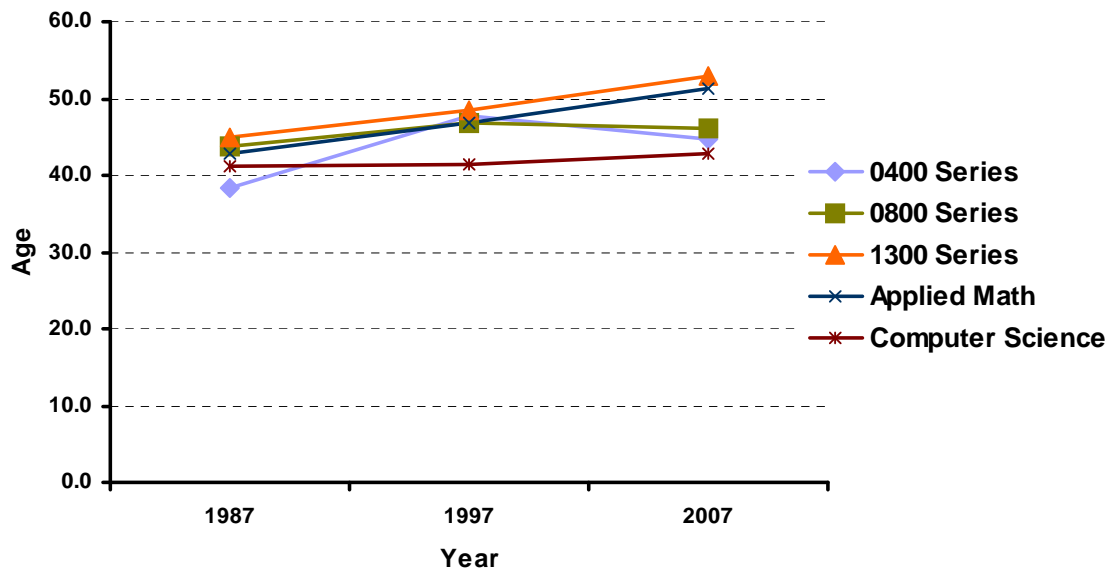


Figure 2. Competency median age.

KEY ASSUMPTIONS, LIMITATIONS, AND HYPOTHESIS

Several key assumptions underlie this study and the forecasted projections, specifically:

1. SSC San Diego's business will continue to change in an evolutionary manner with similar workforce trends.
2. Past retirement trends are predictive of future trends. These trends are key to the "bootstrap" and regression models that rely on past trends continuing on into the future.
3. Demographic trends for SSC San Diego hiring requirements will continue, specifically the need for electrical engineers and computer scientists.
4. The future pool of potential hires will continue on the recent historical trend.
5. Funding trend for SSC San Diego will continue through next 10 years such that the organization will not face a precipitous decline in funding that would dramatically alter its hiring needs.
6. FY2001 data are anomalous because of SSC San Diego ERP introduction.

Aside from these assumptions, several limitations must be considered when interpreting the study results. First, the study focused only on the SSC San Diego full-time permanent civilian scientific workforce, not part-time, temporary, military, or contractor personnel. Second, the study only projects 10 years into the future and relies on only 10 years of historical data for determining hiring and separation trends. Finally, national and California economic and graduation trends were considered, and the study did not rely on local (San Diego) or regional (Southwest Continental United States) to make correlations or projections.

Initially, the study presented three related hypothesis:

1. Inverse correlation between economic strength and ease of recruitment.
2. Positive correlation between economic strength and workforce non-retirement and non-death attrition.
3. Potentially greater number of retirements due to the age of the workforce.

Surprisingly, the unemployment rate was the best predictor of workforce trends, not the gross domestic product as the study initially surmised.

MEASURES OF PERFORMANCE AND EFFECTIVENESS

This study relies primarily on two measures of performance:

1. *Compare SSC San Diego's currently targeted demographic (electrical engineers and computer scientists) with the total U.S. and California population for this demographic.* By comparing the Center's need with the total number in the state and the nation, the leadership can appreciate the magnitude of the effort vis-à-vis total supply.
2. *Compare the projected numbers of future hires required in the next 10 years with the projected trends for SSC San Diego's share of national and California recruit catchments.* This comparison will provide decision-makers with some measure of how large the potential gap between accessions and separations will be in the coming decade.

Measures of performance include current age, level of education, type of education, source of recruitment (school/geographic region), years employed by SSC San Diego, and the years employed by the U.S. Navy, the Department of Defense (DoD), or other U.S. government agencies.

ANALYTICAL FRAMEWORK

The study was structured to determine if the future professional accession needs of SSC San Diego could likely be attained through their current recruiting practices. The study framework followed three workforce planning steps described in the RAND 2005 DoD workforce study (see Figure 1.1 in the Rand study, http://www.rand.org/pubs/monographs/2006/RAND_MG449.pdf) and simply assessed whether a gap would occur between the demand forecast and the supply projection. The workforce planning steps are as follows:

Demand Forecast (number and characteristics of workers required to meet organizational goals)

Supply Projection (projection of current staffing levels and competencies into the future based on current trends)

Gap Analysis (demand forecast compared with supply projection)

The demand forecast was defined as the estimated range of new SSC San Diego employee accessions required to maintain the current force level into 2018 as projected from historical attrition trends. Attrition data were obtained from SSC San Diego's Human Resources Liaison Office manpower records. The supply projection assessed the accessibility and recruitability of a qualified future workforce based on current steady-state graduation rates in specific engineering disciplines. Engineering graduation data were provided by the American Society for Engineering Education (ASEE), which collects statistics on over 95 percent of all accredited U.S. engineering schools.

The gap analysis defined future hiring challenges in the Center's science and engineering (S&E) workforce. The gap, or lack of a gap, was determined by projecting the demand, with adjustments for the local economy as articulated in high and low unemployment projections, against the expected engineering graduate yield from U.S. colleges and universities, California, and SSC San Diego current recruiting targets. Options were provided based on SSC San Diego's projected future recruiting pool within the 2008–2017 timeframe.

ANALYTICAL TOOLS USED

The Civilian Hiring and Attrition Management Program (CHAMP) model (Figure 3) was leveraged to forecast the Center's labor demand over the next 10 years. A bootstrap model was developed in Microsoft Excel® and used to predict the number of retirees in the next 10 years. The number of new hires and separations was predicted over the next 10 years to determine the possibility of a workforce inventory gap.

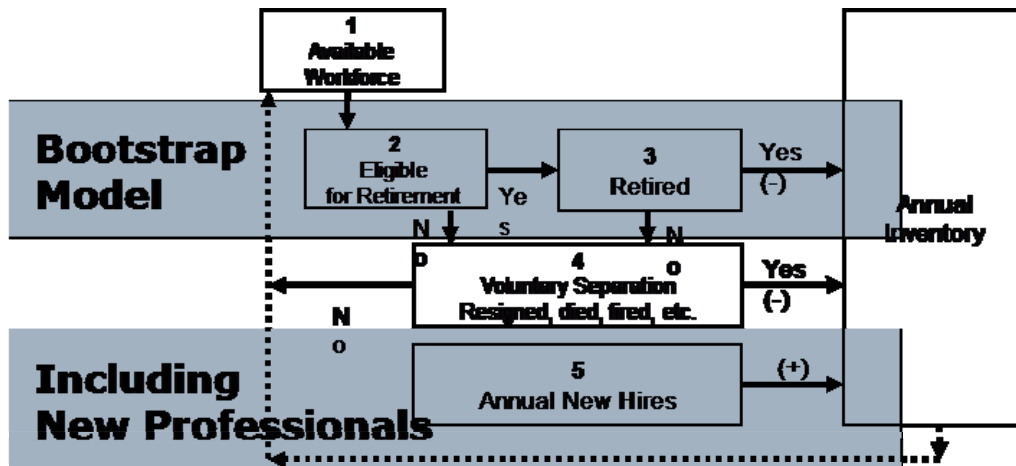


Figure 3. CHAMP model.

In the bootstrap model (Figure 4), the assumption was made that the retirement ages would be consistent with the previous 10 years. First, a cumulative distribution function was computed using the FY98 through FY07 data (Figure 5). In the model, a random number was generated between 0 and 1 for each employee. The random number for each individual was used as a lookup on the cumulative distribution function to determine each employee's retirement age. As each individual's age was incremented each year over the next 10 years, the number of people that were retired that year was recorded. As a check of the model, the FY98 employee data were processed using the model and compared against the actual number of people who retired. Other than the perturbation at start-up due to the current older workforce, the predicted number of retirements over the 9-year period is less than 1 percent different than that of the actual number of retirees (Figure 6). Finally, univariate and multivariate regressions were used to measure the correlation between accession levels and the strength of the economy.

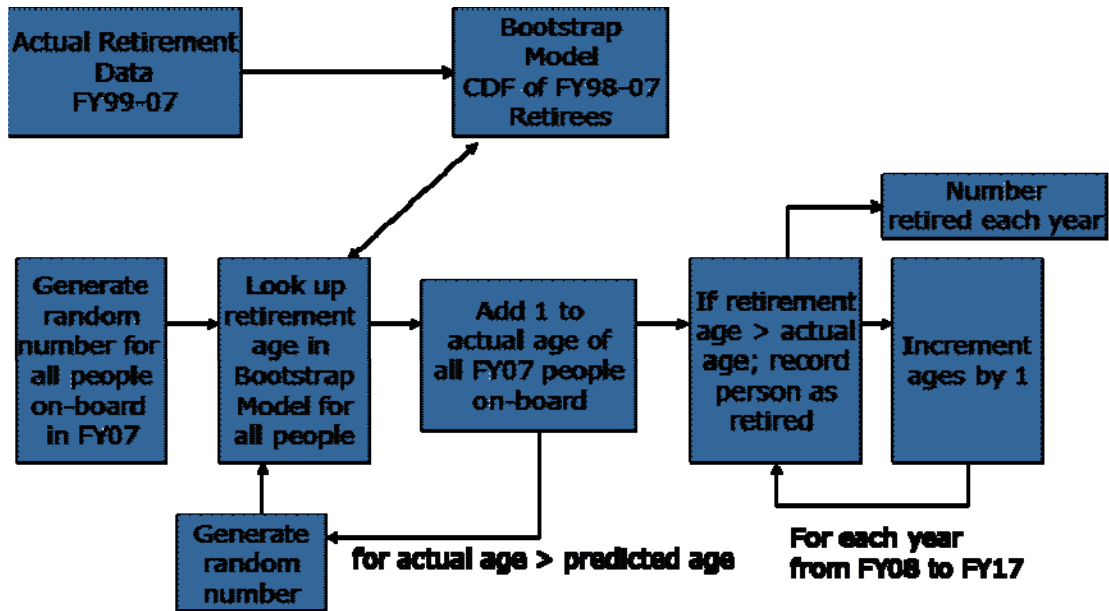


Figure 4. Bootstrap model.

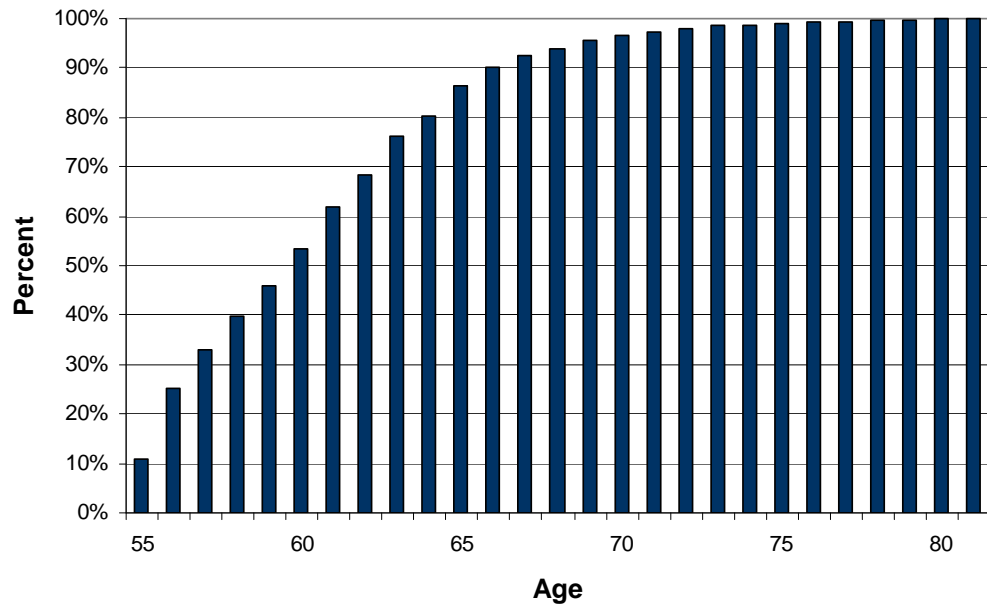


Figure 5. Cumulative distribution function.

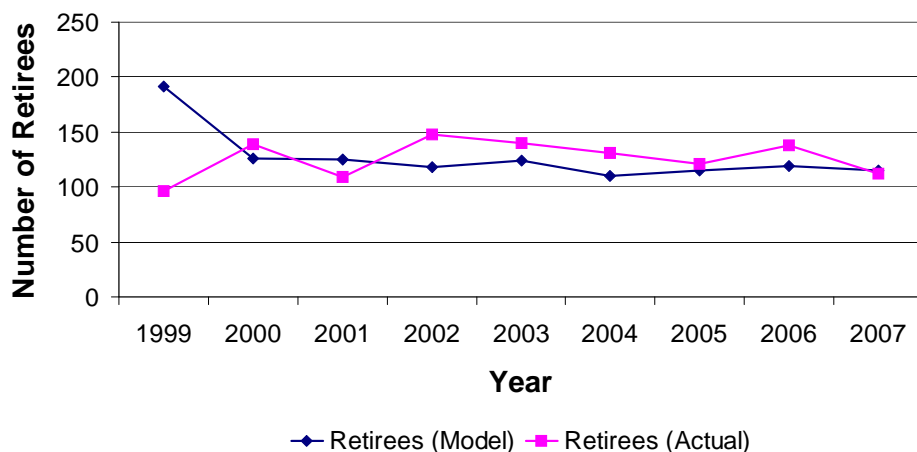


Figure 6. Bootstrap model output data (FY 1998–2007).

ANALYTICAL RESULTS

SSC SAN DIEGO DEMOGRAPHICS—CURRENT WORKFORCE

SSC San Diego provided data from the Office of Personnel Management (OPM) database for FY98 through FY07. These data included the age of each full-time permanent civil service employee onboard, their service time at SSC San Diego, and their total service time in the federal government. The number of full-time permanent civil service employees onboard SSC San Diego varies from an approximate low of 3300 in 2001 to a high of 3660 in 2005 (Figure 7). The dip in FY01 was likely due to the installation of an enterprise resource planning system during which money was only expended on critical mission requirements. This perturbation did not impact the model.

The histogram of the age of FY07 SSC San Diego full-time permanent civil servants reveals that the average age of the current workforce is 46.4 years and is consistent with the national civil service professional workforce at 47 years old² (Figure 8). Figure 8 shows that the data are bimodal, with modes at 29 and 51 years old. The dip is likely due to the DoD-wide hiring freezes during the 1990s. The histogram of SSC San Diego service years reveals that the average number of service years, 16.4 years, is consistent with the national average for full-time permanent professional civil servants at 16 years of service (CBO, 2007). There are two peaks; the first due to hiring after 9/11 and the second due to reduced hiring during the 1990s (Figure 9).

² Congressional Budget Office. 2007. "Characteristics and Pay of Federal Employees," Washington, DC.

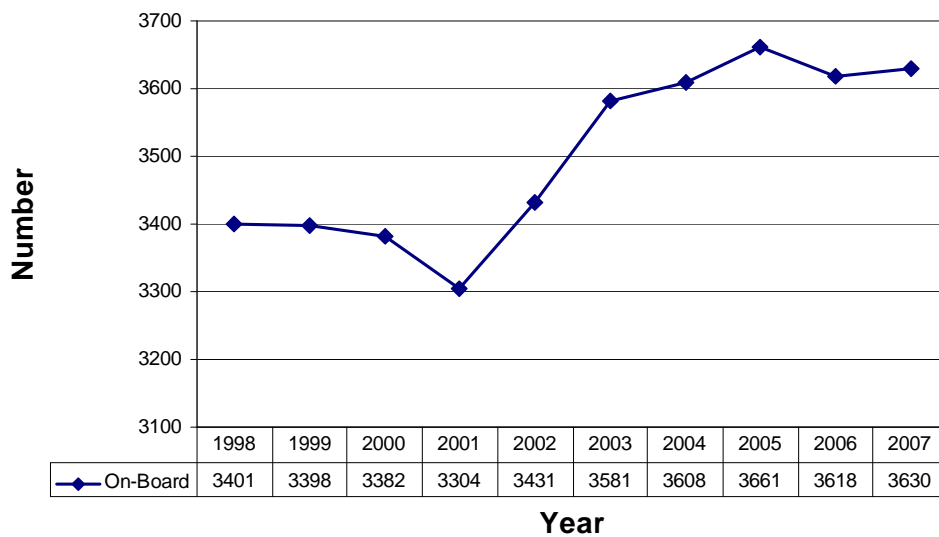


Figure 7. SSC San Diego personnel onboard.

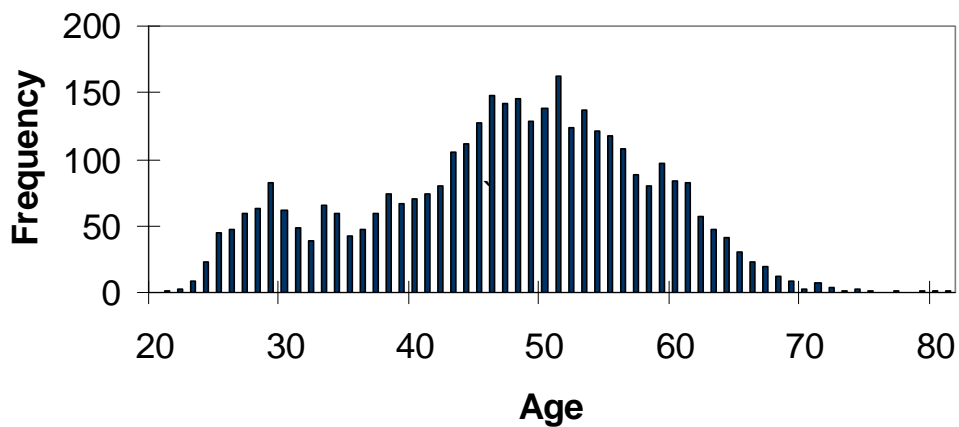


Figure 8. 2007 SSC San Diego workforce histogram.

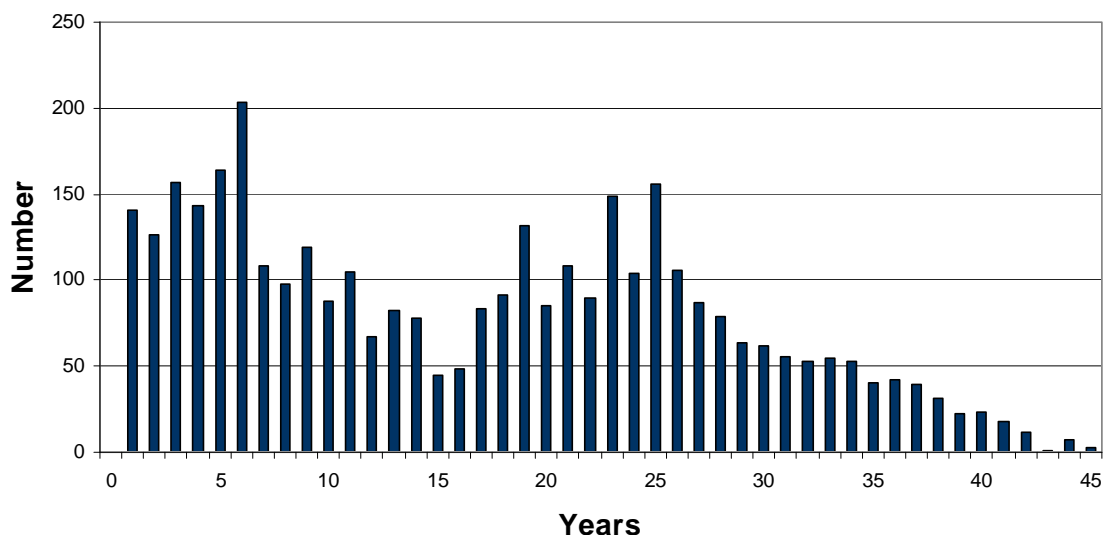


Figure 9. Service years histogram.

SSC SAN DIEGO DEMOGRAPHICS—ATTRITIONS

The histogram of the age of retirees from FY98 to FY07 shows that the average age for retiring at SSC San Diego is 59.6 years and is consistent with the national average for federal professionals at 59 years (GAO, 2005). The largest percentage of people retired at 56 years old. Employees that retired as early as 33 years old primarily left due to medicals reasons (Figure 10).

When SSC San Diego FY07 employee age data were run through the bootstrap model, the computed result was that approximately 1408 full-time permanent civil servants will retire over the next 10 years (Figure 11). The 9-year retirement total for FY08 to FY16 was 1280, which is not very different from 1134, the retirement total for the previous 9 years. Thus, the expectation is that for the next 10 years, the number of retirees at SSC San Diego will continue at the approximate level that it is today. The study results show no strong correlation between retirements and the economy.

The resignations histogram shows that the average resignation age is younger at 37.6 than the national average of 40 for federal professionals (GAO, 2005). Resignations refer to full-time permanent employees who have left government employment. Separations refer to employees who have left SSC San Diego for other government employment such as SPAWAR Headquarters, the Program Executive Office Command, Control, Communications, Computers and Intelligence, etc. Separations were not always entered into the database when the separation occurred and were not used in this study because of the inaccuracies (Figure 12). The total resignations during the previous 10 years indicate that about 60 people (or less than 2 percent of the workforce) resign from SSC San Diego each year (Figure 13). Projected resignations for FY 1998–2016 are shown in Figure 14. The figure also shows the estimated and actual results from FY1998–2007. A negative correlation exists between the resignations and the national unemployment rate (Table 1).

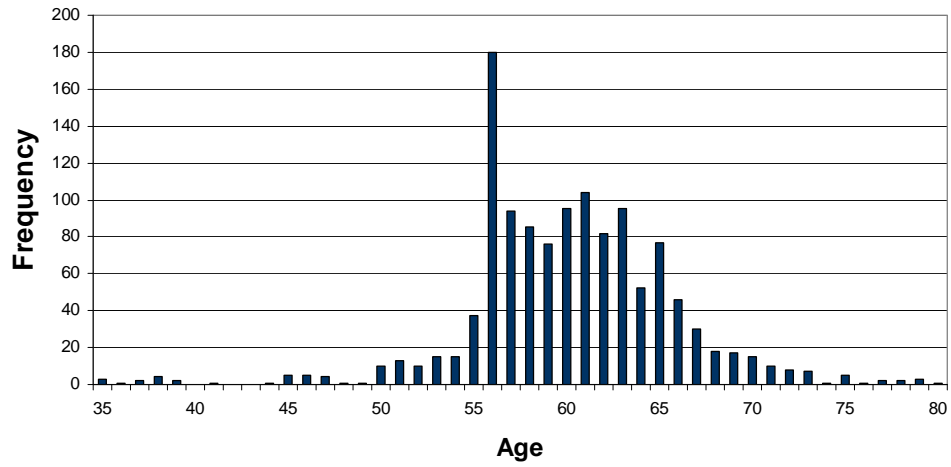


Figure 10. Retirement age histogram (FY 1998–2007).

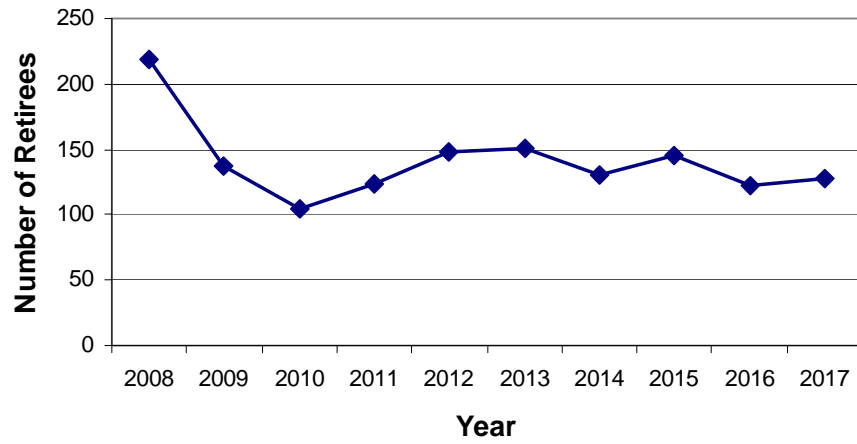


Figure 11. Projected Retirements (FY 2008–2017).

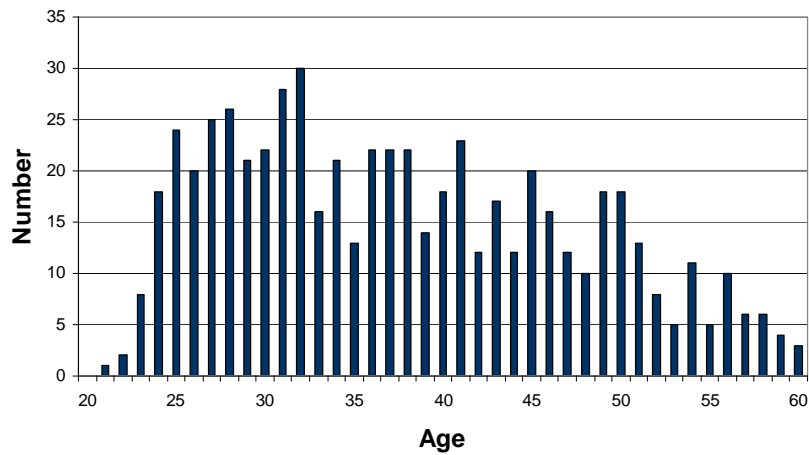


Figure 12. Resignations histogram.

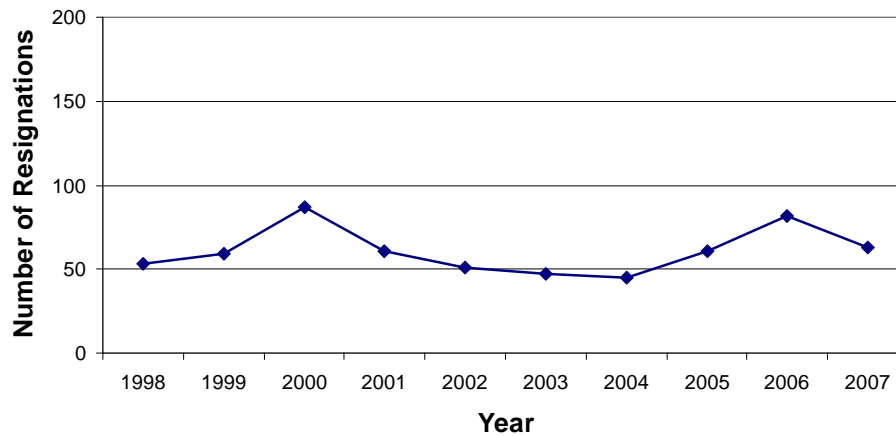


Figure 13. Resignations histogram (FY 1998–2007).

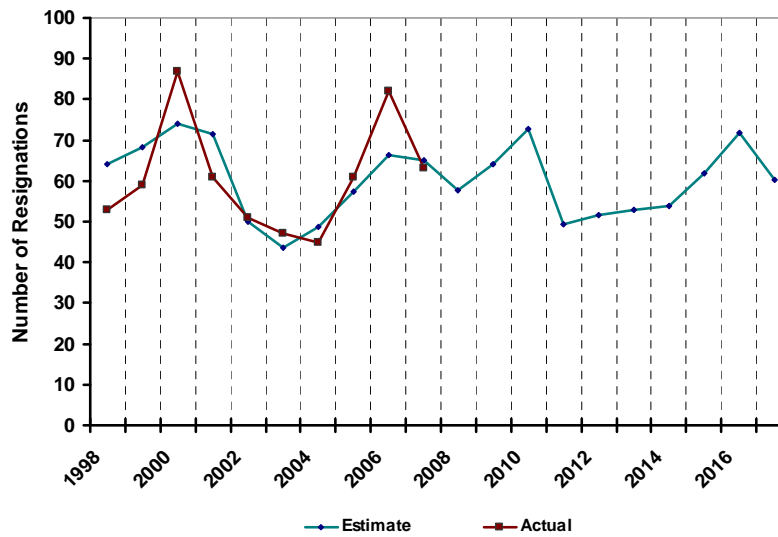


Figure 14. Projected resignations.

Table 1. Pairwise correlation matrix.

	Access	GDP	Unemp	LocGDP
Access	1.00	-0.19	0.73	-0.18
GDP	-0.19	1.00	-0.43	1.00
Unemp	0.73	-0.43	1.00	-0.41
LocGDP	-0.18	1.00	-0.41	1.00

SSC SAN DIEGO DEMOGRAPHICS–ACCESSIONS

Over the last 10 years, from 1998 to 2007, the average number of yearly accessions was 284. New professionals (NPs) are a targeted engineering and scientific population recruited directly from universities into a structured development program; they are predominantly computer engineers, electronics engineers, and computer scientists. They comprise the single largest homogeneous class of hire within SSC San Diego, making up on average of 27.5% of new hires—or around 71 new

professional hires per year. Because such a large segment of the workforce refresh program revolves around the accession of new professionals, SSC San Diego maintains a NP recruiting and tracking program, and employs five recruiters who canvas 95 targeted university campuses.³ The campuses were selected because of their strong engineering schools, past recruiting success and noted diverse populations. They include the top seven engineering schools in California and focus on 21 of the top 25 national engineer producing universities (based on the American Society of Engineering Educators, U.S. University CS, CE, and EE graduation statistics for 2006)⁴. Figure 15 illustrates overall hiring trends over the last decade. Note the jump in total and NP accessions in 2002 and 2003 as compared with the rest of this time period; 2002 NPs have accounted for 25% of total accessions.

Table 2. Top 25 engineer-producing universities and top 25 in undergraduate production.

	University	State	Total US Citizen
1	University of California, Irvine	CA	711
2	Georgia Institute of Technology	GA	667
3	University of Illinois at Urbana-Champaign	IL	504
4	University of California, San Diego	CA	458
5	North Carolina State University	NC	414
6	The University of Texas at Austin	TX	402
7	San Jose State University	CA	381
8	Carnegie Mellon University	PA	374
9	University of Maryland, College Park	MD	362
10	Massachusetts Institute of Technology	MA	348
11	The Johns Hopkins University	MD	340
12	The Pennsylvania State University	PA	318
13	University of Minnesota -Twin Cities	MN	312
14	University of California, Los Angeles	CA	305
15	Virginia Polytechnic Institute and State University	VA	276
16	Brigham Young University	UT	256
17	The University of Texas at Dallas	TX	253
18	Texas A&M University	TX	249
19	University of Florida	FL	232
20	University of Washington	WA	227
21	Stony Brook University	NY	226
22	California State Polytechnic University, Pomona	CA	225
23	California Polytechnic State University	CA	222
24	University of California, Berkeley	CA	217
25	New York Institute of Technology	NY	212

Top 25 in Undergraduate Production

23	Rutgers, The State University of New Jersey	NJ	151
25	The Ohio State University	OH	146

Table 3. Universities in top 25 engineer-producing universities not actively recruited by SSC San Diego.

	University	State	Total US Citizens
3	North Carolina State University	NC	409
5	University of Maryland, College Park	MD	343
13	University of Minnesota -Twin Cities	MN	229
21	Stoney Brook University	NY	226
25	New York Institute of Technology	NY	212

³ New Professional data provided by Joyce Loyd, SSC San Diego College recruiting Coordinator.

⁴ See Tables 2 and 3

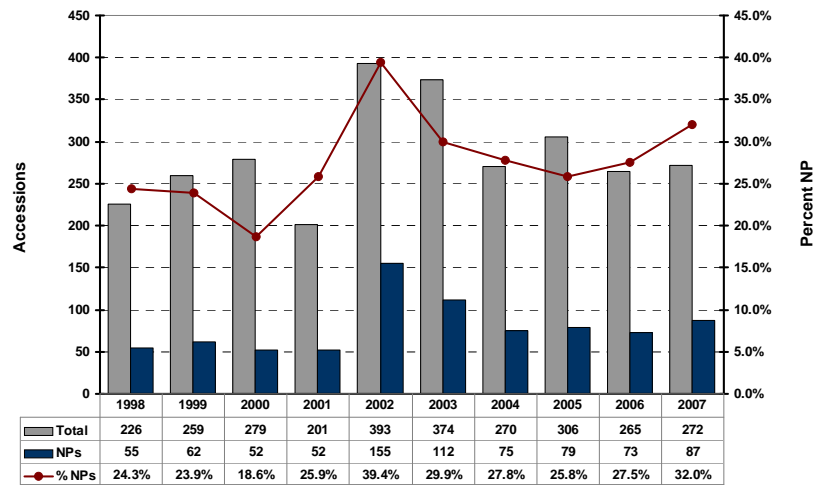


Figure 15. Accession trends (1998–2007).

The recruiting staff works to focus the Center’s workforce priorities, targeting and recruiting almost exclusively computer scientists, electronics engineers, and computer engineers—over the past 10 years they have been very successful at obtaining and exceeding their goal. In a very competitive market, in which they routinely bid against the likes of Hewlett Packard, Qualcomm, and Google, and are further limited to only considering U.S. citizens, they have met the needs of the Center, recruiting an engineering workforce whose college grade point averages were better than 3.5. Notably, since 2002 the average number of annual hires has remained above 70, whereas prior years witnessed a high of 62 since 1999. While 2002 witnessed the highest number of offers and acceptances, 2003 saw the highest acceptance rate of the 10-year period. Figure 16 highlights NP hiring trends.

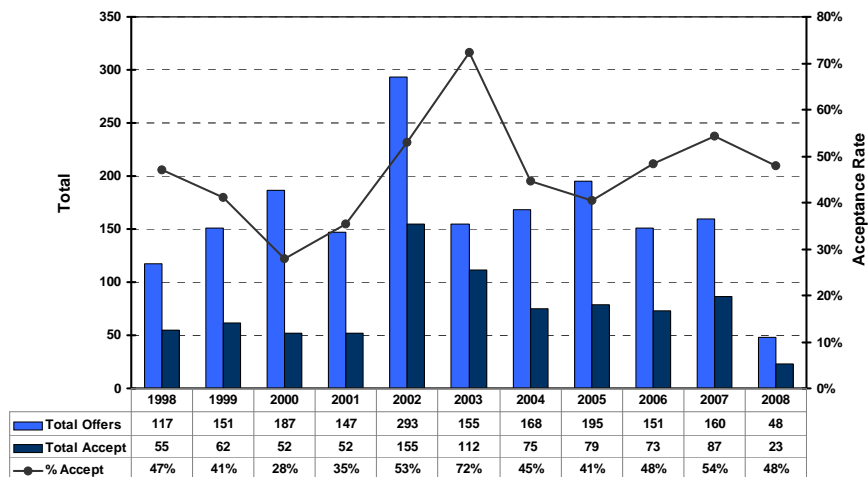


Figure 16. NP hiring trends.

ECONOMIC STRENGTH AND ACCESSIONS

Although this study initially posited that Gross Domestic Product (GDP) growth rate would be a key determinant of accession trends and non-retirement attrition, the study determined that in fact the unemployment rate served as the key determining variable.⁵ Regression analysis confirmed trends illustrated in graphical representations. For example, while the GDP growth rate exhibits a negative correlation with accessions, unemployment projects a stronger relationship with both total accessions and the rate of NP acceptances of offers, as shown in Figures 17 and 18.

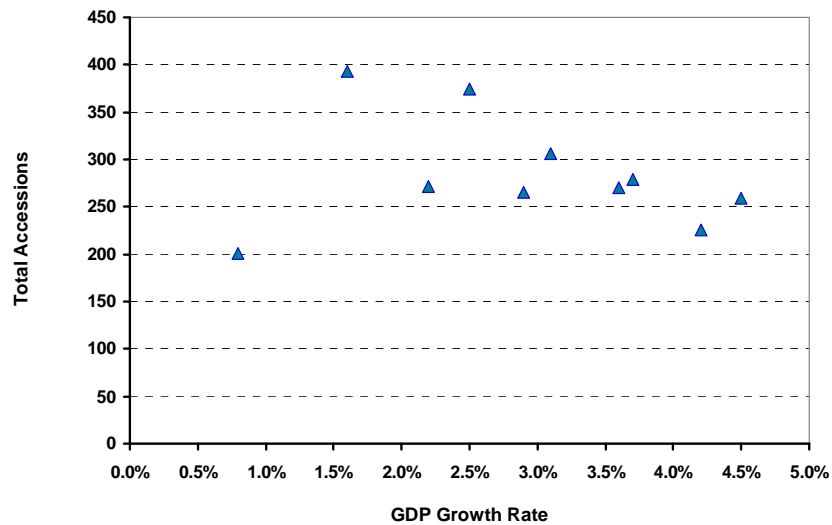


Figure 17. GDP growth rate vs. total accessions.

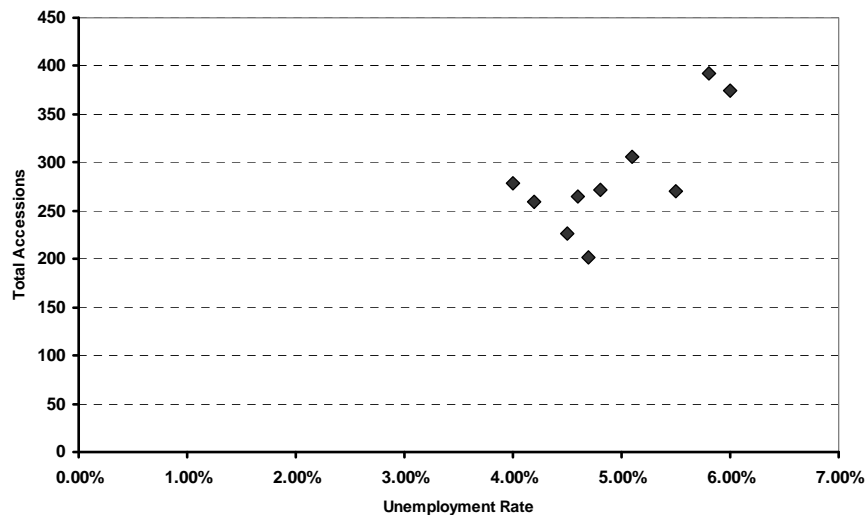


Figure 18. Unemployment rate vs. total accessions.

⁵ Economic data (GDP growth rate and unemployment levels) used in this study came from the Bureau of Economic Analysis, an agency of the Department of Commerce responsible for producing economic account statistics. www.bea.gov

Regression analysis confirmed that unemployment, not GDP growth rate, retained statistically significant correlation with resignations, total accessions, and NP acceptance rates.⁶

NP Rate Regression Model

$$NPRate = -0.278 + 1.385 * GDPRate + 14.267 * UnempRate^7$$

Total Accessions Regression Model

$$Access = -87.615 + 778.947 * NatGDP + 7102.584 * Unemp^8$$

The unemployment rate *positively* correlates with both the NP acceptance rate and the total number of accessions; a higher unemployment rate leads to a higher number of accessions. While not surprising, this statistically-backed/robust conclusion confirms long held assumptions regarding accession levels. To be sure, while one would assume a strong positive relationship between GDP growth rate and unemployment, the attendant correlation matrix found a modest relationship between these variables (see Table 1).

To extrapolate future trends, the regression model was leveraged to project total accessions out to 2017. As Figure 19 demonstrates, assuming past trends carry on into the future, SSC San Diego should be able to meet its hiring needs out to 2017, given a projected annual mean gap of 202 against projected annual accessions of 282.⁹

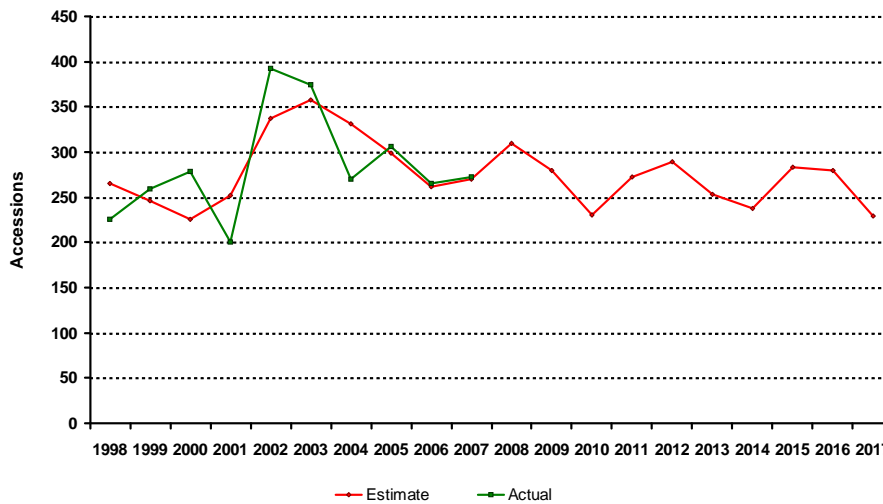


Figure 19. Projected annual accessions (2008–2017)

In addition, the relationship between resignations and the aforementioned independent variables (GDP rate and Unemployment) revealed a *negative*, statistically significant relationship between resignations and unemployment.

Resignations Regression Model

$$Resignations = 154.505 + -317.309 * GDP + -1714.867 * Unem^{10p}$$

⁶ These regressions relied on ten data point for each year from 1998 – 2007.

⁷ Adjusted R-squared: 0.421 GDP Rate t-stat: 0.474 Unemp t-stat: 2.806 F-stat: 4.273, significance: 0.061 Coefficient of variation: 19.8%

⁸ Adjusted R-squared: 0.422 GDP Rate t-stat: 0.540 Unemp t-stat: 2.829 F-stat: 4.287, significance: 0.061 Coefficient of variation: 15.9%

⁹ Used random number generators to extrapolate future projections.

¹⁰ Adjusted R-squared: 0.434 GDP Rate t-stat: -0.954 Unemp t-stat: -2.962 F-stat: 4.452, significance: 0.0570 Coefficient of variation: 17.2%

Thus, a lower unemployment rate begets a higher level of separations than does a higher unemployment rate. Again, while not surprising, it is statistically verified; one can surmise that lower unemployment relates to a greater number of opportunities outside SSC San Diego that entice employees away. From 2008 to 2017, the projected mean number of separations per annum is 60, as illustrated in Figure 19.

It is important to highlight that these regressions only imply correlation, NOT causality. Furthermore, regression forecasts are based on past data, so projections assume a continuation of past trends, an important assumption given recent initiatives that may affect future separation and retirement decisions (NSPS, FERS) which could dramatically alter the above-mentioned projections.

HIRING SOURCES

As previously noted, SSC San Diego relies on scientists and engineers to conduct its mission as a C4ISR research, development, test and evaluation laboratory. In searching for new professionals, SSC San Diego has focused specifically on the disciplines of computer science, electrical engineering, and electrical computer engineering. While bachelor degrees in these disciplines see a high proportion of U.S. citizens, graduate education witnesses a higher percentage of non-U.S. citizens, with two-thirds of doctoral candidates as foreign nationals (see Table 4). The high competition for this level of talent implies that SSC San Diego may need to finance and grow its own doctorates from within the organization, something it has done in the past.

Table 4. U.S. and foreign citizen advanced degrees comparison.

Bachelors Degrees	U.S. Citizens	Foreign Citizens	Total Number Of Degrees
California	4,380	449	4,829
Southwest Region	4,975	516	5,491
United States	26,789	3,065	29,854
Masters Degrees			
California	1,874	1,197	3,071
Southwest Region	1,972	1,387	3,359
United States	8,735	4,647	13,382
Doctoral Degrees			
California	257	341	598
Southwest Region	277	405	682
United States	1,064	2,240	3,304

Data Source: American Society for Engineering Education¹¹

¹¹ Founded in 1893, the American Society for Engineering Education (ASEE) is a nonprofit organization of individuals and institutions committed to furthering education in engineering and engineering technology. ASEE's organizational membership is composed of 400 engineering and engineering technology colleges and affiliates, more than 50 corporations, and numerous government agencies and professional associations. It is the current administrator of the Naval Research Enterprise Intern Program (NREIP) on behalf of the Office of Naval Research. For more information, visit www.asee.org

Currently, SSC San Diego has a very focused recruiting drive on certain disciplines, as well as workforce diversity. Assuming average accession needs of 72 new professionals per year, this amounts to 0.5% of the target market. In a low unemployment scenario, when a lower percentage of offers are accepted, some 304 offers will have to be made to achieve the aforementioned accession needs. This amounts to roughly 2.11% of the target market. In the case of high unemployment (a high 6% during the 1998–2007 period), only 89 offers would have to be made, around 0.62% of the target market. Thus, depending on the strength of the labor market, SSC San Diego will need to vary the number of offers it will have to make to meet the assumed accession needs. Presumably, in a weaker labor market, SSC San Diego can be more selective vis-à-vis those it chooses to hire.

CONCLUSIONS AND RECOMMENDATIONS

SSC San Diego will likely continue to meet its recruiting needs to maintain its professional and technical workforce into the foreseeable future (this study looked out ten years). Its recruiting team has met its hiring requirements in the late 1990s, which was one of the strongest economies (lowest unemployment) in recent history. It has maintained low new professional attrition rates over the last 10 years (10%) and its overall workforce attrition and retirement rate remains well below ten percent for the same period. Even accounting for that a larger than normal percentage of the workforce will become eligible for retirement in 2017, projections showed that even in a strong economy (as articulated in the form of low regional unemployment) SSC San Diego would not suffer an overall workforce shortage.

Where SSC San Diego might not be as fortunate is in the maintenance of graduate and doctorate level educated professionals. While the current US and California education system generates more than enough qualified (US citizen) bachelor level engineers, the study revealed that it does not achieve the same at masters and PhD level. To maintain, or to achieve SSC San Diego's currently stated priority of an increase by two percent the current level of PhD educated employees, SSC San Diego might have to consider other options than recruit from the current pool.

These other options include consider widening its current recruiting aperture to include "best athlete" scholars from other than currently sought after disciplines, as well as enhance current programs to grow new graduate level with a focus on Doctorate degrees, from within the organization.

Another area of concern identified through this study is the increasing age and decreasing population of the theoretical science workforce often identified with the early Science and Technology work accomplished by the Center. SSC San Diego's physicist and mathematician population has effectively halved over the last twenty years while increasing in age to almost seven years greater than the average Center-wide population—they will, on average, be able to retire in the next three years. This population also includes a large plurality of the current PhD population. Left unchecked, this current eventuality could negatively impact the Center's future reputation and capability in the S&T arena and defense R&D laboratory community.

STUDY STRENGTHS, WEAKNESS

This future workforce study exhibited several strengths and weaknesses. The strengths were predominantly in the study group's execution and findings. These strengths included: the attainment of required data sets across the study variables reasonably early in the study period; the development of an effective model in EXCEL; effective analytic support using the available SSC San Diego HR and NP data, the ASEE graduation data, and the BEA economic data. While the study showed that SSC San Diego will likely continue to succeed in recruiting its target population, the study also identified that the physicist and mathematician populations are aging and attriting more rapidly than the rest of the professional population. An immediate outcome of this study was the positive impact it had on the command's human resources data collection; the HR liaison rapidly reviewed and improved the data collection process for this study and future use.

Some of the weaknesses embedded within this study are resultant of time limitations and data limitations. While the ARENA modeling application might have provided a more granular estimation of the future SSC San Diego workforce requirements, the version provided would not accept and process our data. Given the study's time constraints an EXCEL "Bootstrap" model was deemed acceptable. Economic data, which was attained through the Department of Commerce's Bureau of

Economic Analysis, was geographically limited; while the technical sector economic indicators would have enhanced the study, they were not easily obtainable given the studies time constraints. The DoD expectation that all SSC San Diego professionals will be eligible for security clearances required the study to only consider US citizens. Few data sources on university statistics collect with the US citizen discerners; ASEE did, which limited the university data to the engineering disciplines. A few HR data limitations weakened the study. They included: employee education levels are only captured upon initial hiring; resignation data remained incomplete primarily because system currently doesn't have a consistent method for attriting employees who passively separate from a leave-without-pay status.

CODA: FOLLOW-ON STUDY RECOMMENDATIONS

Given these projections, a potential follow-on question for future study is, “what are the potential retention trends for the workforce tracking to retire in the 2020–2030 timeframe?” Much of this workforce was hired after the implementation of the Federal Employee Retirement System (FERS) which allows employees to leave the organization and “take” their retirement with them, akin to a corporate 401(k) retirement program. Potentially, and unlike those under the Civil Service Retirement System (CSRS), a greater number of workers could leave the organization as they are not required to stay in government to receive their retirement. In addition, a new work-culture might develop under the recently instantiated National Security Personnel System (NSPS) which might affect both accession and separation decisions.

APPENDIX A

File names for *The SSC Pacific Future Civil Service Workforce 2008* study are listed below. They include data files from the American Society for Engineering Education (ASEE), the Department of Commerce's Bureau of Economic Analysis (BEA), this study team (MAN Group), the SPAWAR Systems Center San Diego (SSC San Diego) Human Resources Liaison Office (HR), and the New Professional Recruiting Office (NP). Files were submitted separately to the OS4083 Course Professor, CAPT Douglas Otte, USN. They are to be retained at the Navy Postgraduate School.

1. ASEE_2006 Bachelors Degrees by Discipline.xls
2. ASEE_2006 Doctoral Degrees by Discipline.xls
3. ASEE_2006 Masters Degrees by Discipline.xls
4. ASEE_University Data.ppt
5. BEA & SSCSD-NP_Economic Data Grinder.xls
6. MAN Group_Bootstrap Model New Data.xls
7. MAN Group_Data Analysis for OS4083 Project.ppt
8. MAN Group_MultiVarReg_HiringtoGDP.xls
9. MAN Group_MultiVarReg_NPpercentHiringtoGDP_USE.xls
10. MAN Group_MultiVarReg_Resignations_USE.xls
11. SSCSD-HR_Accessions 1998-2007.xls
12. SSCSD-HR_Age-Service 1998-2007 mod 1.xls
13. SSCSD-HR_Age-Service 9-30-07 mod 8.xls
14. SSCSD-HR_Prof Govt Occupational Series.doc
15. SSCSD-HR_RESIGNATIONS 1998-2007 rev.xls
16. SSCSD-HR_Retirement review 10 years REV.xls
17. SSCSD-HR_S&E 2007-1987 age-avg&median.xls
18. SSCSD-NP & ASEE_College University Actual EOD 06-06 (2)-w-avail-pop.xls

REPORT DOCUMENTATION PAGE				Form Approved OMB No. 0704-01-0188	
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1. REPORT DATE (DD-MM-YYYY) 08-2008		2. REPORT TYPE Final		3. DATES COVERED (From - To)	
4. TITLE AND SUBTITLE THE FUTURE SSC PACIFIC CIVIL SERVICE WORKFORCE				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHORS P. Shigley G. Pennoyer J. Carreño				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) SSC San Diego San Diego, CA 92152-5001				8. PERFORMING ORGANIZATION REPORT NUMBER TR 1971	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Naval Postgraduate School 1 University Circle Monterey, CA 93943				10. SPONSOR/MONITOR'S ACRONYM(S) NPS	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.					
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14. ABSTRACT Current demographic trends for SPAWAR Systems Center San Diego (SSC San Diego) accessions versus separations remain unclear, particularly as the organization faces a potential retirement wave. This study supports strategic leadership decisions on future recruitment and retention initiatives by providing visibility into future hiring, providing understanding of the make-up and availability of qualified future hire pools, assessing future Center demographic trends. Two distinct findings were derived from this study. First, based on current hiring priority and assuming past accession and separation trends hold constant over the 2008-2017 timeframe, SSC San Diego's recruiting will most likely continue to meet accession needs over the study's projected 10-year timeframe. Recruitment efforts are currently focused on Electrical Engineering, Computer Engineering, and Computer Science. Second, SSC San Diego's science and technology physical scientists and mathematics workforce is changing rapidly. Over the last 20 years, the population of physicists has declined by 20 percent while that of mathematicians has dropped by 40 percent. Both of these disciplines have and continue to age more rapidly than other disciplines, with a median age of 53 years. Over the long term, this trend may negatively impact the Center's ability to maintain its current research and development as well as science and technology capability.					
15. SUBJECT TERMS Mission Area: Science, Technology, and Engineering demographic trends gap analysis CHAMP model recruitment retention bootstrap model					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			P. Shigley
U	U	U	UU	31	19b. TELEPHONE NUMBER (Include area code) (619) 553-2101

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